CLAIMS

What is claimed is:

1. A finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane;

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror; and

an aberration correction system that collects the light reflected from the first mirror and transmits it toward the image plane.

2. The system of claim 1, wherein the positional relationship between the object and the first mirror creates a large angular field of view, greater than about ten degrees.

3. The system of claim 2, wherein the aberration correction system substantially corrects off-axis optical aberrations that result from the large angular field of view.

4. The system of claim 1, wherein the aberration correction system comprises a refractive lens group.

5. The system of claim 4, wherein the refractive lens group comprises at least three lenses.

6. The system of claim 4, wherein a refractive lens that is the closest to the image plane has a substantially planar surface that faces the image plane.

7. The system of claim 5, further comprising an optical sensor responsive to light from the object.

8. The system of claim 7, wherein the optical sensor comprises a charge-coupled device.

9. The system of claim 1, wherein the object comprises a plurality of samples disposed in a multiple-well plate.

10. The system of claim 6, wherein the object comprises a plurality of samples disposed in a multiple-well plate.

11. The system of claim 1, wherein the light is due to photoluminescence emission from the object.

12. The system of claim 1, wherein the object side Numerical Aperture is between about 0.01 and about 0.1.

13. The system of claim 1, wherein the magnification of the system is less than about 2.

14. A finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane, wherein the positional relationship between an object and the first mirror creates a large angular field of view, greater than about 10 degrees;

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror;

an aberration correction system comprising a refractive lens group that collects the light reflected from the first mirror and transmits it toward the image plane, wherein the aberration correction system substantially corrects off-axis optical aberrations that result from the large angular field of view;

wherein the object side Numerical Aperture is between about 0.01 and about 0.2; and

wherein the magnification of the system is less than about 2; and

an optical sensor responsive to light from the object.

15. The system of claim 14, wherein the aberration correction system comprises a refractive lens group.

16. The system of claim 14, wherein the light is due to luminescence emission from the object.

17. The system of claim 14, wherein the refractive lens group comprises at least three lenses.

18. The system of claim 14, wherein the optical sensor comprises a charge-coupled device.

19. The system of claim 14, wherein the object comprises a plurality of samples disposed in a multiple-well plate.

20. A system for simultaneously measuring fluorescent emission from each of a plurality of samples disposed in a multiple-well plate, the system comprising:

a light source that provides illumination of a first wavelength that excites the fluorescent emission of light of a second wavelength from the plurality of samples;

a finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane;

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror; and

an aberration correction system that collects the light reflected from the first mirror and transmits it toward the image plane; and

an optical sensor that is responsive to the second wavelength of light from the plurality of samples and positioned to receive light from the light imaging system.

21. The system of claim 20, wherein the aberration correction system comprises a refractive lens group.

22. The system of claim 21, wherein the refractive lens group comprises at least three lenses.

23. The system of claim 20, wherein the object side Numerical Aperture is between about 0.01 and about 0.2.

24. The system of claim 20, wherein the magnification of the system is less than about 2.

25. The system of claim 20, wherein the optical sensor comprises a charge-coupled device.

26. A system for simultaneously measuring fluorescent emission from each of a plurality of samples disposed in a multiple-well plate, the system comprising:

a light source that provides illumination of a first wavelength that excites the fluorescent emission of light of a second wavelength from the plurality of samples;

a finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane;

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror; and

an aberration correction system that collects the light reflected from the first mirror and transmits it toward the image plane, wherein the aberration correction system comprises a refractive lens group;

wherein the object side Numerical Aperture is between about 0.01 and about 0.2;

wherein the multiple-well plate is positioned on the object side of the imaging system; and

wherein the magnification of the system is less than about 2; and

a charge coupled device responsive to the second wavelength of light and positioned to receive light from the imaging system.

27. A reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane; and

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror;

wherein light reflected by the first mirror is directed toward a single image plane.

28. A reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane; and

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror;

wherein the positional relationship between the object and the first mirror creates a large angular field of view, greater than about 1 degree.

29. The system of claim 27, wherein the magnification of the system is less than about 2.

30. The system of claim 29, wherein the system is a finite conjugate system.

31. The system of claim 29, wherein light reflected by the first mirror is directed toward a single image plane.

32. The system of claim 31, further comprising an optical sensor proximate the single image plane

33. A finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane;

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror; and

an optical sensor proximate the image plane responsive to light from the object;

wherein light reflected by the first mirror is directed toward the image plane;

and wherein the magnification of the system is less than about 2.

34. A finite conjugate reflective light imaging system comprising, in order from an object side toward an image plane:

a first mirror comprising a central aperture and a concave reflective surface, the concave reflective surface facing the image plane; and

a second mirror comprising a convex reflective surface facing the object side, wherein light from an object passes through the central aperture and is reflected by the convex reflective surface toward the concave reflective surface of the first mirror;

wherein the positional relationship between the object and the first mirror creates a large angular field of view, greater than about 1 degree.

35. A system for simultaneously measuring or monitoring luminescence from a plurality of samples disposed in a multiple-well plate, the system comprising:

a first reflective surface with optical power that directs light from the plurality of samples toward an image plane; and

an optical sensor proximate the image plane, the optical sensor being responsive to the luminescence from the plurality of samples and being positioned to receive light from the first reflective surface.

36. The system of claim 35, wherein the luminescence comprises fluorescence.

37. The system of claim 35, wherein the first reflective surface faces the image plane and includes a central aperture.

38. The system of claim 37, further comprising a second reflective surface with optical power, wherein luminescence from the plurality of samples passes through the central aperture and is reflected by the second reflective surface toward the first reflective surface.

39. The system of claim 38, further comprising an aberration correction system that collects the light reflected from the first reflective surface and transmits it toward the image plane.

40. The system of claim 39, wherein the aberration correction system comprises at least one refractive element with optical power, the refractive element forming an optical window of the optical sensor.

41. A system for simultaneously measuring or monitoring fluorescence from a plurality of samples disposed in a multiple-well plate, the system comprising:

a first reflective surface with optical power that directs light from the plurality of samples toward an image plane, the first reflective surface facing the image plane and including a central aperture;

a second reflective surface with optical power, wherein luminescence from the plurality of samples passes through the central aperture and is reflected by the second reflective surface toward the first reflective surface;

an optical sensor proximate the image plane, the optical sensor being responsive to the luminescence from the plurality of samples and being positioned to receive light from the first reflective surface; and

an aberration correction system that collects the light reflected from the first reflective surface and transmits it toward the image plane, the aberration correction system including at least one refractive element with optical power, the refractive element forming an optical window of the optical sensor.